



**U.S. Environmental Protection Agency
Region 4
Science and Ecosystem Support Division
West Louisville Air Toxics
Monitoring Study Results**



**Louisville, Kentucky
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INTRODUCTION

From April 2000 -April 2001, Jefferson County Air Pollution Control District (JCAPCD), the United States Region 4 Environmental Protection Agency (EPA) and the University of Louisville conducted a joint air toxics monitoring study of the Rubbertown area of West Louisville. The primary objective of the air toxics monitoring portion of this project was to determine if residents of the neighborhoods surrounding the Rubbertown area were being exposed to airborne concentrations of hazardous air pollutants that might pose unacceptable health risks. The attached results are only for the samples that were analyzed by the EPA Science and Ecosystem Support Division, in Athens, Georgia.

BACKGROUND

The project encompasses the most densely concentrated area of industry within the state of Kentucky. Bounded by the Ohio River and downtown Louisville, it encompasses portions of both the City of Louisville and Jefferson County, as well as the "Rubbertown" industrial complex -- a 4-square mile area of large industries. There are approximately 70,000 residents in the project area, of which about 65% are minorities, while approximately 40% live below the poverty level.

Rubbertown was initially developed in support of military activities during World War II. After World War II, it was developed into a large industrial complex. Within this relatively small area are many of the largest industrial facilities within the Region. The Rubbertown industrial facilities have been emitting a wide variety of pollutants into the environment for approximately 50 years. Consequently, there are considerable multi-faceted environmental concerns in the area for both the community and regulators. Citizens are concerned with adverse impacts to air and surface water quality due to ongoing industrial practices and the cumulative environmental and health effects from the concentration of industry in their community. The public is also concerned that improper waste disposal practices, which were routine prior to the 1970s, have resulted in contamination of the land and groundwater.

A Task Force, including representatives from the neighborhood associations and other community members, industry, environmental groups and local government, recently identified six environmental concerns of highest priority, 15 recommendations and 38 action items. The top six priorities of the community include: industrial odors in the area; air pollution; surface water quality; community "right to know" and access to environmental information; the need for health assessments; and access to quality, affordable health care. Based on available data, the EPA Region 4 West Louisville CBEP Team has identified hazardous air pollutants, ozone, and indoor air quality as posing a potentially high risk to the community.

The air toxics study began in April 2000 and continued for one year. An objective of the study was to obtain data of sufficient quality to allow a risk assessment to be conducted. Appendix A lists the detection limits required to conduct this assessment. Appendix B lists the detection limits of the methods used by SEDS. The detection limits were of adequate sensitivity for the majority of the target compounds to support a risk assessment based upon the air toxics data collected.

Air was monitored for volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), formaldehyde, reactive aerosols, and metals in suspended particulate. In addition, meteorological data was collected.

The EPA Data Quality Objectives (DQO) Process has been utilized in the design of the Quality Assurance Project Plan (QAPP). The steps taken in the DQO process are summarized in Table 1.

ELEMENTS OF THE PROJECT

1. PROJECT MANAGEMENT

Responsibility for the analysis of the 12 sites was divided between the EPA, Region 4, Science and Ecosystem Support Division (SESD) and the University of Louisville (U of L). JCAPCD collected samples at all twelve sites. SEDS assisted JCAPCD with installation of equipment at six of the sites. SEDS conducted the laboratory analyses on samples collected at those six sampling sites, and provided technical assistance. SEDS provided quality assurance overview of the contract lab used for the formaldehyde analysis, internal quality assurance, quality assurance of the JCAPCD functions, and technology transfer assistance as JCAPCD requested.

2. MEASUREMENT/DATA ACQUISITION

SESD was responsible for the analysis of samples from six air monitoring site locations listed in Table 3. The objectives for selecting the sites are provided in Table 2.

The study's primary focus was VOCs. But, to more completely characterize the area six sites were equipped for the collection of air samples for analysis of VOCs, SVOCs, formaldehyde, acidic aerosols and metals in particulate. The sampling was conducted for 24 hour periods once every 12 days.

Table 1

DQO Process as utilized for Louisville Air Toxics Study

DQO Step	DQO Action
1. State the Problem	Residents of the Rubbertown area of Louisville, Kentucky are concerned that they are being exposed to unsafe concentrations of toxic air pollutants as the result of atmospheric releases of pollutants by local industries.
2. Identify the Decision	By utilizing data collected during this year-long study of toxic air pollutants in the Rubbertown area, EPA plans to conduct a risk assessment of the area to determine whether the residents are being exposed to unsafe concentrations of toxic air pollutants.
3. Identify the Inputs of the Decision	The major pollutants listed in the SARA TRI data for the area were considered along with their release amounts and toxicity. This monitoring plan monitors for the majority of hazardous air pollutants emitted in the Rubbertown area of Louisville.
4. Define the Study Boundaries	The study was confined to the area shown in Figure 1 with the study area focused on neighborhoods located near the Rubbertown area.
5. Define a Decision Rule	The air toxics study used established EPA monitoring methods. It utilized a 1/12 day sampling scheme to provide a statistically representative characterization of air toxics concentrations in the study area.
6. Limits of Decision Errors	All methodology is derived from the EPA's "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air" and the "Compendium of Methods for the Determination of Toxic Inorganic Compounds in Ambient Air" and Kentucky's Division of Environmental Services (DES) Standard Operating Procedures. The duplicate samples were used to provide a measure of method error.
7. Optimize the Design	This study plan was peer reviewed by a panel of experts in disciplines ranging from analytical chemistry, to risk assessment, to air toxics monitoring.

All of the air samples were collected as specified in the SESD **Environmental Investigations Standard Operating Procedures and Quality Assurance Manual**, (EISOPQAM), May 1996. All samples were collected by JCAPCD. The analytical data was in SESD's computerized laboratory information system (R4LIMS).

Table 2
Siting Objectives

SITE TYPE	MONITORING OBJECTIVE
1. Potential maximum impact sites.	Objective was to characterize potential exposure of individuals living in areas where maximum impact from industries in the Rubbertown area could have occurred. Were located in areas of modeled maximum concentration of pollutants in neighborhoods near existing Rubbertown industries.
2.General neighborhood population exposure sites	Objective was to characterize the typical exposure of individuals living in areas located in the vicinity of the Rubbertown area.
3.Background site	Objective of this site was to assess the pollutant concentration in the air mass as it is transported into Jefferson County. It was located in a generally upwind location far enough away to not typically be impacted by emissions from the Rubbertown industrial complex.
4.Control site	The objective of this site was to determine the air quality in residential areas of Jefferson county that should not often be impacted by emissions from the Rubbertown industrial complex. It was located in an area not often downwind of the Rubbertown industrial complex but an area still likely impacted by vehicle emissions.

Table 3
AIR TOXIC MONITORING SITES -West Louisville Area

SAMPLE ID NUMBER	Site Name Site Address	Monitoring Target	Parameters	Comments
1	Louisville Police Firearms Training <i>4201 Algonquin Pkwy</i>	Fenceline	VOC, SVOC, HCl and HF, formaldehyde, metals SO ₂ Meteorological	Maximum impact site for BF Goodrich, Zeon Chemicals, Geon Chemicals, Marathon Ashland Petroleum LLC, CITGO, BP Oil, Chevron USA Oil Terminals, Ashland Chemical, Police Firearms Training facility, and Morris Foreman POTW
2 and 3 (duplicate site)	Ralph Ave/ Campground Road <i>4211 Campground Rd.</i>	Fenceline General Neighborhood	VOC, SVOC, HCl and HF, formaldehyde metals Duplicate Monitors	Maximum impact site for DuPont, Rohm & Haas, Elf Atochem, American Synthetic Rubber Community exposure site for northern Cane Run neighborhood
4	Old Lake Dreamland Fire Dept. <i>4603 Campground Rd.</i>	Fenceline General Neighborhood	VOC, SVOC, HCl and HF, formaldehyde, metals	Maximum impact area for American Synthetic, Rohm & Haas, Elf Atochem, and Borden Chemical Community exposure site for Lake Dreamland and Cane Run neighborhoods
5	St. Stephens Baptist Church <i>1008 S 15th</i>	General Neighborhood	VOC SVOC, HCl and HF, formaldehyde, metals	Community exposure site for Russell, Parkland and California neighborhoods
6	U of L Shelby Campus <i>9001 Shelbyville Rd.</i>	Control	VOC, SVOC, HCl and HF, formaldehyde, metals	Control site to measure the impact of urban anthropogenic activities
7	Otter Creek Park <i>850 Otter Creek Park Rd, Brandenburg</i>	Background	VOC, SVOC, HCl and HF, formaldehyde, metals	Background site 25 miles southwest to assess transport of pollutants from outside of the metropolitan area into the study area

The VOCs were collected in six-liter Silcosteel canisters using flow controllers to allow the pre-evacuated canister to fill slowly over a 24-hour period. The sampling was initiated by an electronic timer that opened a solenoid valve and allowed the air to begin to flow into the canister. At the end of the 24 hour sampling interval the timer would close the solenoid valve sealing the cylinder. The flowrate was adjusted to allow approximately 5100 cc of air to be collected in the 6000cc canister during a 24 hour period. The sampling conformed to method **TO-15** of the EPA **Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air.**

The SVOCs were collected by the high volume PUF/XAD method. A high volume PUF/XAD sampler consisting of a glass fiber filter with a polyurethane foam

(PUF) and XAD (a proprietary resin) backup absorbent cartridge was used. Approximately 300 M³ of air was sampled during a 24 hour period. The sampling conformed to **TO-13A** of the EPA **Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air**.

Formaldehyde were collected on dinitro-phenylhydrazine saturated silica-gel Sep-Paks (DNPH cartridges). Approximately 1440 liters of air was sampled through the DNPH cartridges. The sampling conformed to **TO-11A** of the EPA **Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air**.

The suspended particulate were collected by the High Volume Particulate Method. The sampling conformed to **40 CFR 50 Appendix G**.

A meteorological station was operated at the Fire Training site in the Rubbertown area. The meteorological station consisted of a 10 meter tower, wind speed and direction transducers, and a temperature sensor. The station was connected to a data logger. JCAPCD was responsible for polling the site daily with their central data acquisition computer and downloading the meteorological data.

ANALYTICAL METHODS

All analysis conformed to the SESD Analytical Support Branch Quality Action Plan. The formaldehyde samples were analyzed by Precision Analytical, Simi Valley, California; all the other analysis were performed by the SESD laboratory. All samples were accompanied by chain of custody documents. The VOC and formaldehyde were analyzed within one month of the sample date. The semi-volatile organic compounds and metals were analyzed within two months of the sample dates.

The SVOC samples were extracted from the particulate filter and backup PUF/XAD adsorbent in a Soxhlet extraction unit for approximately 24 hours using 95% hexane/5% ether. The cartridge was extracted within one week of sample collection. The extract was then analyzed by GC/MS using EPA method **TO-13A**.

The formaldehyde samples were eluted from the DNPH cartridges and analyzed by HPLC using EPA method **TO-11A**.

A one inch strip was cut from the high volume particulate filters as per **40 CFR 50 Appendix G** and then extracted using the hot acid procedure and analyzed by ICP-MS.

The reactive aerosol samples were extracted and analyzed by ion chromatography using **Kentucky's Division of Environmental Services Method Number KY-4650**.

The VOC samples were analyzed by GC/MS in full scan mode according to EPA method TO-15.

3. DATA ASSESSMENT/ OVERSIGHT

The following quality assurance steps were taken:

One of the six sites had a co-located duplicate set of samplers (VOC sampler, SVOC sampler, formaldehyde sampler, and high volume particulate sampler for metals). This will determine the precision of each method from sample collection through analysis. Both the VOC and SVOC samples had surrogate compounds added to the sample prior to analysis to verify that the analytical procedure is acceptable. Method blanks were analyzed with each set of samples. For the VOCs, one canister was checked for each batch that was cleaned to verify the effectiveness of the canister cleanup. Initial and final pressures were recorded for each VOC sample taken to verify that there were no pneumatic leaks. Every 10th particulate filter was analyzed in duplicate to verify the accuracy of metals analysis. Every 10th reactive aerosol sample was analyzed in duplicate to verify analytical results.

4. DATA VALIDATION and USABILITY

SESD-ASB performed validation in accordance with ASBs QAM for the data generated by SESD. The formaldehyde data provided by Precision Analytical Laboratories was validated by SESD's QA group in accordance with method-specific and laboratory established QC requirements. These requirements included the evaluation of initial and continuing calibrations, method blank analyses, laboratory spike recoveries (for accuracy and precision measurements – where applicable), field blank analyses, proper identification of analytes and holding times criteria. Qualification of analytical data deemed outside these criteria were assigned one of the following data flags:

“J” – Estimated based on non-adherence to applicable QC criteria including data outside the range of analytical standards used to calibrate the instrument.

“R” – Analytical data considered unusable and rejected.

Additional data flags assigned to compliant data (i.e., those that meet QA/QC requirements) are as follows:

“U” – Material was analyzed for but not detected; the number is the minimum quantitation limit

“A” – Average value

“N” – Presumptive evidence of presence of material

The majority of the J values found in the data were the result of the concentration being below the SESD quantitation limit (which corresponds to the lowest concentration standard that was used to calibrate the instrument) but above the detection limit. The JN flagged compounds were usually tentatively identified compounds (TIC). TICs reported for organic compounds detected by gas chromatography/mass spectrometry for which standards were not run. The spectra of the unknown compounds were compared to a NIST library standard mass spectra. Because no standard was prepared for these compounds, positive identification and accurate quantitation were not possible; hence the presumptive evidence of presence of material (N) and estimated value (J) flags.

During the study, one of the Rubbertown industries, Dupont-Dow, raised questions about the accuracy of the chloroprene standard gas being used by both U of L and SESD. Dupont-Dow had supplied the original stock chloroprene to Spectra Gas (the company that supplied both SESD and U of L with their VOC standards.) To resolve this question, Dupont-Dow created a new chloroprene stock standard which they supplied to Spectra Gas, along with special handling procedures designed to minimize potential degradation of the chloroprene. Spectra Gas then prepared a new chloroprene gas standard. Both EPA and U of L analyzed this new chloroprene gas standard. EPA's analysis showed the new chloroprene gas standard to be nominally 22% greater than the standard that was used to calibrate the GC/MS during the study. U of L's analysis showed the new standard to be 5.9% greater than their standard that was used during the study. The small differences are less than either labs QA action limits for changing or flagging data.

Another issue resulted in applying the "R" Rejected flag to five formaldehyde samples collected at the Otter Creek background site. The SESD performance audit of 5/15/00 found the pump had malfunctioned at the Otter Creek site. SESD sent JCAPCD a new pump and plumbing to resolve the problem, but during the SESD audit of 7/12/00 discovered that the pump tubing had been installed incorrectly. The inlet of the sampler at Otter Creek had been hooked to the outlet of the pump. Therefore, no ambient air was being sampled by the apparatus and the samples that were collected during this time were invalid. This resulted in data for the following formaldehyde samples from the Otter Creek site being flagged with a "R" reject flag:

Project #	Sample date
00-0574	05/12/2000
00-0577	05/24/2000
00-0658	06/05/2000
00-0661	06/17/2000
00-0861	07/11/2000

There were a number of failures of the SESD GC/MS and ancillary equipment used to analyze the VOC samples, beginning in April 2000 continuing through January 2001. This resulted in a number of VOC samples exceeding holding times and Kentucky's Department of

Environmental Protection analyzing three sets of VOC samples for the project to prevent three additional samples exceeding holding times. The sample dates affected are as follows:

EXCEEDED HOLDING TIMES – The J flag (estimated value) was applied to all VOC data for the sample dates:

Project number	Sample Date
00-0521	04/18/2000
00-0524	04/30/2000
00-0573	05/12/2000
01-0024	10/27/2000
01-0110	11/08/2000
01-0232	01/21/2001

To avoid having additional samples exceed holding times, the following three sets of VOC samples were shipped to the Kentucky DEP laboratory for analysis:

Project number	Sample Date
00-0576	05/24/2000
00-0657	06/05/2000
00-0660	06/17/2000

In addition, the VOC samples from project numbers 01-0113 and 01-0154 were flagged with the J flag because the internal standard recoveries on the samples were less than 50%. i.e., the QC was outside ASB action limits and there was no reason to re-run the samples to get better QC because then they would be flagged for missing holding time. The data from 01-0575 had an NA for the Freon, dichlorodifluormethane, because of high levels in the blank. No reason was ever found for the contamination of that blank.

Project number	Sample Date
01-0113	11/20/2000
01-0154	12/02/2000
01-0575	04/13/2001

The data including non-detects and all other flagged data is attached in a CD-ROM containing the SESD data in dBase format.